

探索 Iris（鸢尾花）数据集

CS245 数据科学基础 陆朝俊

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1 问题描述

统计学主要研究事物的数量方面，目的是探索数据集的数量特征。而统计学中的描述统计学借助图表或概括性的数值将数据集展示为清晰可理解的形式。在之前的研究中，已经使用了图表对 Adults 数据集进行了探索和可视化展示，这次研究的主要目标是探索 Iris 数据集，并通过一些概括性的数值对其进行展示，详细目标如下：

1. 探索 Iris 数据集的基本属性（如数据集总体描述、数据维数、特征名称等）；
2. 探索各特征的最小值、最大值、均值、中位数、标准差；
3. 探索各特征之间，以及特征与目标之间的相关性（相关系数）

2 解决方案

3 结果展示

3.1 Iris 数据集基本属性

表 1: Iris 数据集基本属性

属性	值
实例的数据个数	150
实例的数据类型	numpy.ndarray
实例的数据维数	(150, 4)
特征名	萼片长度，萼片宽度，花瓣长度，花瓣宽度 (单位均为 cm)
实例的类别值	0,1,2
实例的类别维数	(150,)
类别名称	setosa(清风藤), versicolor(云芝), virginica(锦葵)

3.2 各特征的数值描述

3.3 各特征及特征与目标之间的相关性

A 附录

A.1 Iris 数据集的其余基本属性

A.1.1 Iris 数据集的基本描述

表 2: Iris 数据集各特征的数值描述*

	萼片长度	萼片宽度	花瓣长度	花瓣宽度
最小值	4.3	2.0	1.0	0.1
最大值	7.9	4.4	6.9	2.5
均值	5.843	3.054	3.759	1.120
中位数	5.80	3.00	4.35	1.30
标准差	0.825	0.432	1.759	0.761
方差	0.681	0.187	3.092	0.579
极差	3.6	2.4	5.9	2.4
下四分位数	5.1	2.8	1.6	0.3
上四分位数	6.4	3.3	5.1	1.8

表 3: Iris 数据集各特征及特征与目标之间的相关性

	萼片长度	萼片宽度	花瓣长度	花瓣宽度
萼片长度	1.000	-0.109	0.872	0.818
萼片宽度	-0.109	1.000	-0.421	0.357
花瓣长度	0.872	-0.421	1.000	0.963
花瓣宽度	0.818	-0.357	0.963	1.000
目标	0.783	-0.420	0.949	0.956

Notes

Data Set Characteristics:

:Number of Instances: 150 (50 in each of three classes)
 :Number of Attributes: 4 numeric, predictive attributes and the class
 :Attribute Information:
 – sepal length in cm
 – sepal width in cm
 – petal length in cm
 – petal width in cm
 – class:
 – Iris–Setosa
 – Iris–Versicolour
 – Iris–Virginica
 :Summary Statistics:

	Min	Max	Mean	SD	Class	Correlation
sepal length:	4.3	7.9	5.84	0.83	0.7826	
sepal width:	2.0	4.4	3.05	0.43	–0.4194	
petal length:	1.0	6.9	3.76	1.76	0.9490	(high!)
petal width:	0.1	2.5	1.20	0.76	0.9565	(high!)

:Missing Attribute Values: None
 :Class Distribution: 33.3% for each of 3 classes.
 :Creator: R.A. Fisher
 :Donor: Michael Marshall (MARSHALL%PLU@io.arc.nasa.gov)
 :Date: July, 1988

This is a copy of UCI ML iris datasets.
<http://archive.ics.uci.edu/ml/datasets/Iris>

The famous Iris database, first used by Sir R.A Fisher

This is perhaps the best known database to be found in the pattern recognition literature. Fisher's paper is a classic in the field and is referenced frequently to this day. (See Duda & Hart, for example.) The data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant. One class is linearly separable from the other 2; the latter are NOT linearly separable from each other.

References

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- Gates, G.W. (1972) "The Reduced Nearest Neighbor Rule". IEEE
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- See also: 1988 MLC Proceedings, 54–64. Cheeseman et al's
AUTOCLASS II
conceptual clustering system finds 3 classes in the data.
- Many, many more ...

B 主要代码

Iris 数据集探索代码

```

1 from sklearn import datasets
2 import stats
3 import numpy as np
4 import xlwt
5
6 class IrisAnalyzer(object):
7     def __init__(self):
8         # iris data
9         self.iris = datasets.load_iris()
10        self.data = self.iris.data
11        self.target = self.iris.target
12        print(self.iris.DESCR)
13
14        # save results as excel tables
15        self.wbk = xlwt.Workbook()
16        self.char_sheet = self.wbk.add_sheet('各特征分析')
17        self.corr_sheet = self.wbk.add_sheet('相关分析')
18        self.metrics = {'max': np.max, 'min': np.min, 'avg': np.mean,
19                        'median': np.median, 'ptp': np.ptp,
20                        'std': np.std, 'var': np.var, 'q1': stats.quantile
21                        ,
22                        'q3': stats.quantile}

```

```

22
23     # initialize the excel tables
24     for i, name in enumerate(self.iris.feature_names):
25         self.char_sheet.write(0, i + 1, name)
26     for i, m in enumerate(self.metrics.keys()):
27         self.char_sheet.write(i + 1, 0, m)
28     for i, name in enumerate(self.iris.feature_names):
29         self.corr_sheet.write(0, i + 1, name)
30     for i, m in enumerate(self.iris.feature_names):
31         self.corr_sheet.write(i + 1, 0, m)
32     self.corr_sheet.write(i + 2, 0, 'target')
33
34     print('—————analyzer_ started —————')
35
36 def run(self):
37     # starting to analyze Iris dataset
38     self.basic_att()
39     self.char_analysis()
40     self.corr_analysis()
41
42     self.wbk.save('results.xls')
43     print('—————results_ saved —————')
44
45 def basic_att(self):
46     # get basic attributes of Iris dataset
47     with open('basic_att.txt', 'w') as f:
48         f.write(self.iris.DESCR + '\n\n')
49
50         f.write('Type_ of_ data:_' + str(type(self.data)) + '\n\n')
51         f.write('Shape_ of_ data:_' + str(self.data.shape) + '\n\n')
52         f.write('Feature_ names:_' + str(self.iris.feature_names) +
53                 '\n\n')
54
55         f.write('Target:_' + str(self.target) + '\n\n')
56         f.write('Type_ of_ target:_' + str(type(self.target)) + '\n\n')
57         f.write('Shape_ of_ target:_' + str(self.target.shape) + '\n\n')
58         f.write('Target_ names:_' + str(self.iris.target_names) + '\n\n')
59
60 def char_analysis(self):
61     # analyzing each of characters
62     for i in range(self.data.shape[1]):
63         char_data = self.data[:, i]
64         for j, m in enumerate(self.metrics.keys()):
65             if not m in ['q1', 'q3']:
66                 self.char_sheet.write(j + 1, i + 1, self.metrics[m](char_data))
67             elif m == 'q1':

```

```

67         self.char_sheet.write(j + 1, i + 1, self.metrics[m
68             ](char_data, p=0.25))
69     elif m == 'q3':
70         self.char_sheet.write(j + 1, i + 1, self.metrics[m
71             ](char_data, p=0.75))
72
73     def corr_analysis(self):
74         # analyzing the correlations
75         for i in range(self.data.shape[1]):
76             char_data = self.data[:, i]
77
78             # corr among characters
79             for j in range(self.data.shape[1]):
80                 self.corr_sheet.write(j + 1, i + 1, np.corrcoef(
81                     char_data, self.data[:, j])[0][1])
82
83             # corr between characters and target
84             self.corr_sheet.write(j + 2, i + 1, np.corrcoef(char_data,
85                 self.target)[0][1])
86
87     def debug():
88         # just used to debug , ignore it
89         pass
90
91     if __name__ == '__main__':
92         ia = IrisAnalyzer()
93         ia.run()

```